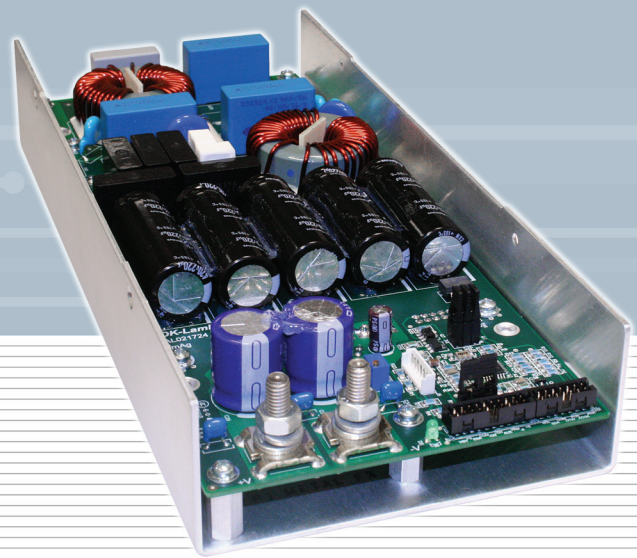


TDK-Lambda Convection and Conduction Cooled AC/DC Power Supplies



Innovating Reliable Power

TDK-Lambda's broad selection of convection and conduction cooled power supplies are ideally suited for applications that do not rely on fans for cooling. Eliminating fans reduces audible noise, possible mechanical fan failure, required maintenance, and also increases system reliability.

Convection Cooled



Series	Power	Outputs	Voltage	Current	Features	Cooling
CSW	40-65W	1	5-54V	up to 8A	Convection Cooled ITE	Convection
CFE	300W/400W	1	12-48V	up to 33.3A	Medical and ITE Power Supplies	Convection
CM4	425-600W	4	1.5-232V	up to 100A	Medical and ITE Modular	Convection
CUS-LD	79-252W	1	3.3-48V	up to 50A	Convection Cooled ITE	Convection
CUS-M	30-600W	1	5-48V	up to 50A	Convection Cooled Medical & ITE	Convection
CUT75	35-75W	2 to 3	5-24V	up to 8A	No Minimum Load	Convection
DRB	15-480W	1	5-48V	up to 20A	DIN Rail Mount - High Efficiency	Convection
DRF	120-960W	1	24V	up to 40A	DIN Rail Mount - High Efficiency	Convection
DRL	10-100W	1	12-24V	up to 4.5A	DIN Rail Mount, Low Profile	Convection
DT	25-300W	1	5-54V	up to 25A	Desktop Medical Power Supplies	Convection
EVS300	300W	1	12-18V	up to 16.7A	Constant Current	Convection
GWS	250W	1	12-48V	up to 21A	High Efficiency - Enclosed	Convection
HWS-A	15-150W	1	3.3-48V	up to 30A	Limited Lifetime Warranty	Convection
KM	15-60W	1 to 3	3.3-24V	up to 10A	Medical PCB-Mount - Encapsulated	Convection
KPS-B	5-25W	1	3.3-48V	up to 4A	Low Profile ITE Power Supplies	Convection
KAS	2-4W	1	3.3-24V	up to 1.2A	PCB Mount - Encapsulated	Convection
KWS-A	5-25W	1	5-24V	up to 5A	PCB Mount - Encapsulated	Convection
LS	25-150W	1	3.3-48V	up to 40A	Low Cost - Enclosed	Convection
LWT	15-50W	3	5-24V	up to 8A	Low Profile Power Supplies	Convection
RWS-B	50-150W	1	5-48V	up to 21A	Enclosed Power Supplies	Convection
WMM	25-30W	1	5-24V	up to 5A	Wall Mount Medical Power Supplies	Convection
ZPSA	20W-100W	1	3.3-48V	up to 8A	Open Frame 2"x4"	Convection
ZW	10-440W	1 to 4	3-52V	up to 30A	Open Frame Power Supplies	Convection

Conduction Cooled



Series	Power	Outputs	Voltage	Current	Features	Cooling
CPFE	1000W	1	12-48V	up to 60A	Conduction Cooled Power Supplies (MIL STD 461/462D CE102 EMC)	Conduction
CPFE1000FI	720-1000W	1	12-48V	up to 60A	Conduction Cooled Power Supplies	Conduction
PFE-SA, -F & -FA	300-1000W	1	12-48V	up to 60A	Harsh Environment Power Module	Conduction
CM4	425-600W	4	1.5-232V	up to 100A	Medical and ITE Modular	Conduction
PFH500F	500W	1	12-48V	up to 42A	Harsh Environment Power Module	Conduction



Convection Cooled



Convection

Applications

- ◆ Industrial
- ◆ Medical
- ◆ COTS
- ◆ Test
- ◆ Communication
- ◆ LED
- ◆ Broadcast
- ◆ Food and Beverage

Features

- ◆ Universal AC Input
- ◆ High Efficiency
- ◆ High Convection Ratings
- ◆ Medical & ITE Safety Approvals

Product Types

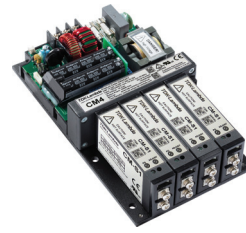
- ◆ Open Frame
- ◆ Chassis Mount
- ◆ PCB Mount
- ◆ DIN Rail
- ◆ External Desktop
- ◆ Wall Mount Adapters



CFE Series

300W/400W Medical & ITE

- ◆ Suitable for B and BF Type Medical Equipment
- ◆ 94% Efficient, 0.5W Standby Power
- ◆ 450W Peak Loading (10s)
- ◆ Suitable for 1U applications
- ◆ 5 Year warranty



CM4 Series

425 to 600W Modular Power Supply

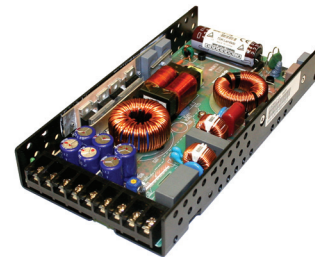
- ◆ Medical & ITE convection/conduction cooled
- ◆ 1U high
- ◆ Wide output adjustment
- ◆ Up to 4 outputs
- ◆ No minimum loading required
- ◆ 5 year warranty



CSW Series

40-65W Wide AC-DC Input

- ◆ 90 - 305VAC Input
- ◆ Convection Cooled
- ◆ U Channel or Enclosed
- ◆ Class 2, 24V model approve to UL1310
- ◆ DIN Rail Mount option
- ◆ 3 year warranty



CUS-LD Series

79 to 250W Single Output

- ◆ High Efficiency, up to 90%
- ◆ Low profile
- ◆ Wide Range AC Input
- ◆ Convection Cooled
- ◆ Coated PCB as standard on CUS250LD
- ◆ 3 year warranty



CUS350M Series

200 to 350W/420W Medical & ITE

- ◆ High Efficiency, up to 94%
- ◆ Low profile
- ◆ Convection Cooled, and Forced Air Ratings
- ◆ 5V Standby & 12V Fan Output
- ◆ 3 year warranty

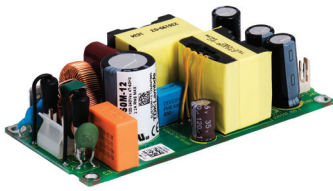


CUT Series

35-75W Triple Output

- ◆ 1.06" high
- ◆ No minimum loads
- ◆ 5V isolated from outputs 2 & 3
- ◆ Convection Cooled
- ◆ Optional cover and terminal type
- ◆ 3 year warranty



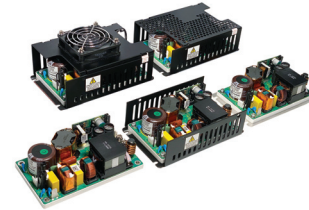


CUS 30/60/100ME/150/200M Series



30-250W Medical & ITE

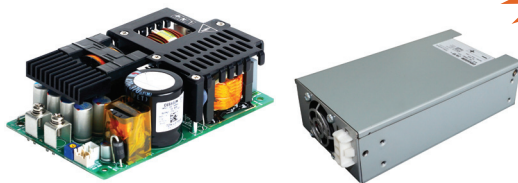
- ◆ 2 x 3", 2 x 4" & 3 x 5" Footprints
- ◆ Low profile
- ◆ Class I & II for some models
- ◆ Suitable for B and BF Type Medical Equipment
- ◆ 3 to 5 year warranty



CUS400M Series

400W Medical 3" x 5" AC-DC Power Supplies

- ◆ 250W (400W peak) Convection / Conduction Cooled
- ◆ Medical Certifications (2 x MOPP)
- ◆ Suitable for B and BF Type Medical Equipment
- ◆ Class B Conducted and Radiated EMI
- ◆ Suitable for Class I and Class II Installations
- ◆ Compact 3 x 5 x 1.55" Size
- ◆ Enclosure & Signal Options



CUS600M Series

600W 3" x 5" AC-DC Medical Power Supplies

- ◆ 400W (600W Peak) Convection Cooled
- ◆ Medical Certifications (2 x MOPP)
- ◆ Suitable for B and BF Type Medical Equipment
- ◆ Class B Conducted and Radiated EMI
- ◆ Suitable for Class I and Class II Installations
- ◆ Compact 3 x 5 x 1.46" Size
- ◆ Enclosure & Other Options



DRB Series

15W to 480W High Efficiency DIN Rail Mount

- ◆ Excellent efficiency – up to 93%
- ◆ ErP compliant, very low no load power consumption
- ◆ Market leading case width
- ◆ Output voltages 5, 12-15, 24, 48VDC
- ◆ 15W, 30W, 50W, 100W and 480W models
- ◆ 3 year warranty



DRF Series

120W to 480W High Efficiency DIN Rail Mount

- ◆ Excellent efficiency – up to 94%
- ◆ Extremely narrow case
- ◆ Market leading no load power consumption
- ◆ ErP compliant, Remote On/Off, 24VDC output
- ◆ Droop Mode Current Share, 150% peak power for 4s
- ◆ 5 year warranty



DRL Series

10-100W Low Profile DIN Rail Mount

- ◆ Low profile for building automation
- ◆ Class II double insulation
- ◆ ErP compliant, very low no load power consumption
- ◆ 10W, 30W, 60W & 100W models
- ◆ 3 year warranty

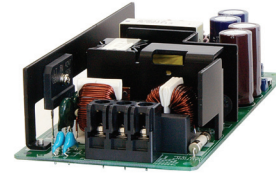


Desktop DT Series



25W to 300W Adaptor / External power

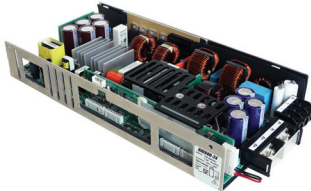
- ◆ EISA and CEC Compliant (most models)
- ◆ Compact package size
- ◆ Single Outputs up to 54V
- ◆ Medical or Industrial Certifications
- ◆ Energy Efficiency Level V & VI models
- ◆ 3 year warranty



EVS300 Series

300W Constant Current

- ◆ Suitable for battery charging
- ◆ 12-18V compliant voltage
- ◆ Adjustable current settings
- ◆ 5 year warranty



GXE600 Series



600W Single Output Programmable Medical and ITE Power Supplies

- ◆ Convection Cooled
- ◆ Up to 95% Efficient
- ◆ RS-485 Read-Write Communication (Modbus RTU protocol)
- ◆ Constant Voltage & Constant Current Modes
- ◆ Monitoring & Programming Functions
- ◆ Digital or Analog Programming
- ◆ 7 year warranty



GWS Series

250W, 500W Single Output

- ◆ High Efficiency, up to 93%
- ◆ 1.6" high (For 1U racking)
- ◆ Wide Range AC Input
- ◆ 250W Convection Cooled
- ◆ 5 year warranty



HWS-A Series

15-150W High Quality Industrial & Medical Power

- ◆ Long Field Life
- ◆ Semi F47 Compliant (230VAC)
- ◆ Medical Certification (HWS/ME)
- ◆ Conformal Coating, -40°C Startup (HWS/HD)
- ◆ Limited Lifetime Warranty (click for terms and conditions)



KAS Series

2-4W Wide AC-DC Input PCB-Mount

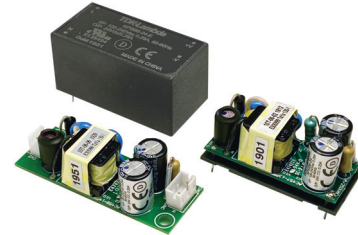
- ◆ 90-305VAC input
- ◆ Class II (no ground needed)
- ◆ Wide temperature range -40 to +80°C
- ◆ Low off-load power consumption
- ◆ 3 year warranty



KMS & KMS-A Series

15-60W Medical AC-DC PCB-Mount

- ◆ Small size and lightweight
- ◆ PC Board Mountable
- ◆ Wide Range Input
- ◆ Medical Safety Certifications (4kVAC Input - Output)
- ◆ Class II (No ground needed)



KPSB Series

5 to 25W Board Mount

- ◆ Industrial Certifications
- ◆ Class B EMI
- ◆ Low Cost and Compact Size
- ◆ Class II Input
- ◆ Low no load power consumption
- ◆ Wide operating temperature



KWSA Series

5-25W Industrial AC-DC PCB-Mount

- ◆ Small size and lightweight
- ◆ PC Board Mountable
- ◆ Wide Range Input
- ◆ Wide operating temperature range -40 to +85°C
- ◆ Class II (No ground needed)
- ◆ 3 year warranty



LS Series

25-200W, 3.3-48V, up to 40A, Low Cost

- ◆ Very low cost
- ◆ Small size
- ◆ 115VAC or 230VAC input
- ◆ Withstands 300VAC surges (5s)
- ◆ 3 year warranty



LWT Series

17-50W Triple Output

- ◆ 26mm height
- ◆ Outputs 2 and 3 isolated from output 1
- ◆ Universal Input (85 - 265VAC)
- ◆ Low Profile Wattbox design on LWT
- ◆ 1 year warranty



RWSB Series

50W to 600W Single Output Low Cost

- ◆ Cost Effective
- ◆ Wide Range AC Input
- ◆ Compact Size
- ◆ Enclosed, Convection Cooled 50-150W Models
- ◆ Fan cooled, 300 & 600W Models
- ◆ 5 year warranty





WMM Series

25-30W Wall Mount Adaptor / External

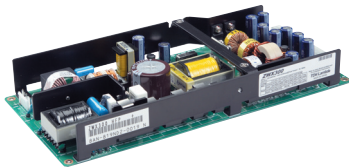
- ◆ Medical Safety Certifications and Immunity
- ◆ 4kV (2xMOPP) Input to Output Isolation
- ◆ Meets DoE Level VI and EU Tier 2 Efficiency
- ◆ Class II, Wide Range Input
- ◆ Alternative Connectors and Cable Assemblies
- ◆ Low Cost and Compact Size



ZPSA Series

20W to 100W Single Output

- ◆ 2 x 3.5", 2 x 4" & 3 x 5" Footprints
- ◆ Wide Range AC Input
- ◆ Low Profile
- ◆ Global Safety Agency Compliance
- ◆ EN61000-4 Immunity
- ◆ 2 year warranty



ZW Series

10-300W Single & Multiple Output

- ◆ 85-265 universal input
- ◆ Open frame
- ◆ ZWQ 1U quad output models from 80-170W
- ◆ ZWD Dual 5V to 24V output models from 120-225W
- ◆ ZWS-BP (150W, 240W) to be added (peak power 2x)
- ◆ 3 to 5 year warranty



Understanding Convection Cooled Power Supplies

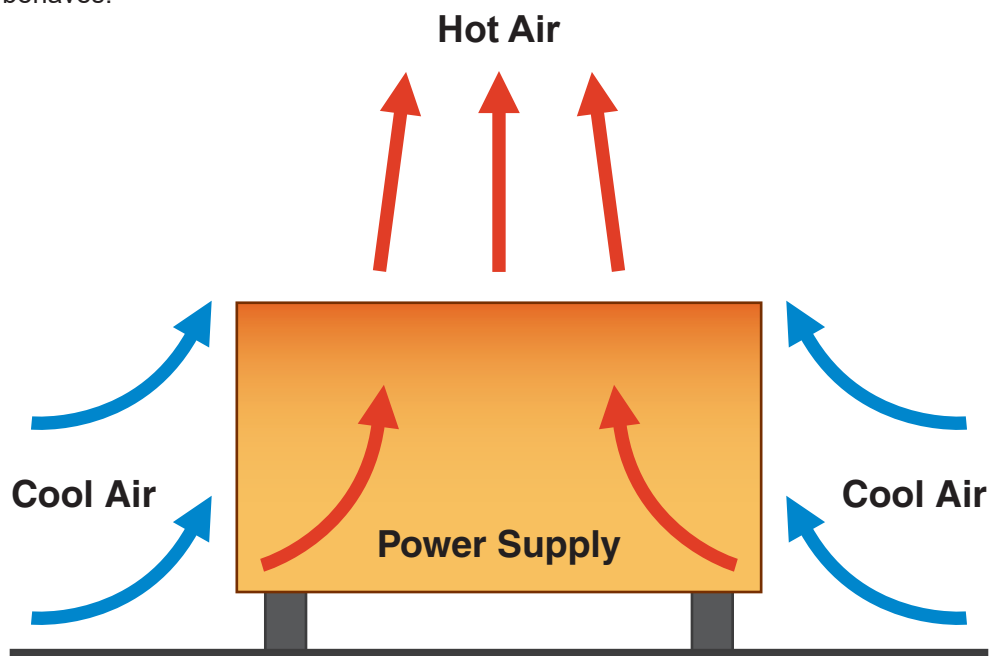
There are a number of commonly used terms to describe cooling methods in the power supply industry:

Fan cooled	Unit has an internal fan
Convection cooled	Unit requires no fan cooling
Forced air cooled	Unit requires external airflow
Conduction cooled	Unit relies on a cold plate to remove the waste heat

The most misunderstood and hence most misapplied is probably convection cooled. Many Engineers assume that a convection cooled power supply is one that does not need any airflow to operate.

One definition of convection is “The transfer of heat by the circulation or movement of the heated parts of a liquid or gas”. In our case – the circulation or movement of hot air.

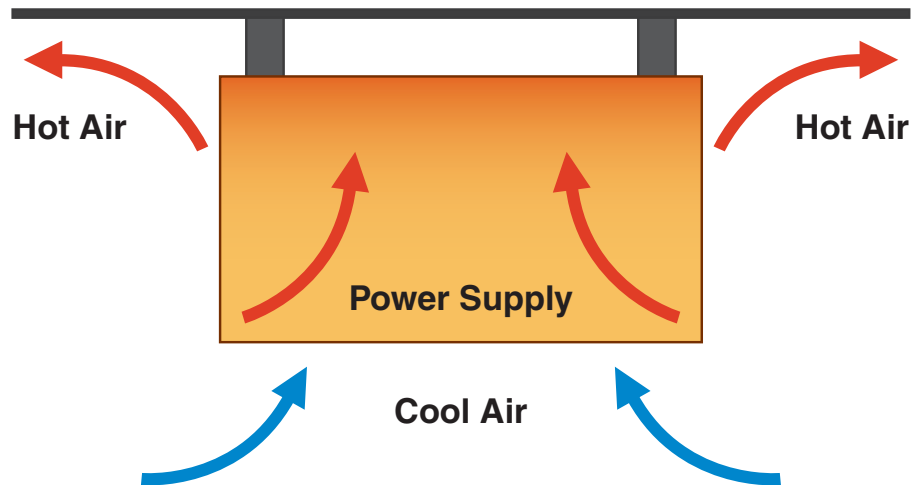
Open frame power supplies, for example, are typically mounted on a flat surface upon standoffs, and below we can see how the air behaves.



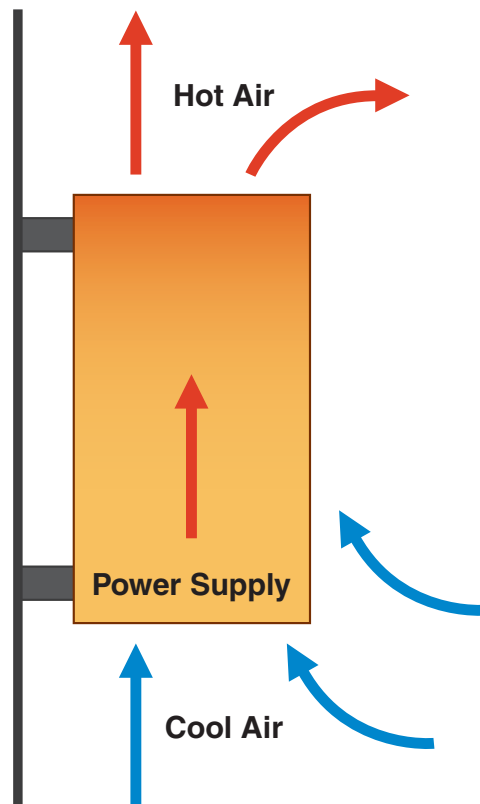
As the hot air rises, cooler air is drawn in from the sides. Although the airspeed is quite low, just 0.3m/s, it is sufficient to reduce internal temperatures. When the power supply goes through safety certification, this is taken into account during thermal testing.

It is very important to ensure that there is adequate space for the air to be drawn in from the sides and allowed to exit above the power supply. A distance of 50mm is considered safe.

Orientation of the product is also very important. Most manufacturers will state a recommended mounting orientation and any derating associated if that is not followed. Mounting the product upside down for example can severely reduce field life unless heavy derating is applied, and is often forbidden.



The ramifications of mounting the power supply vertically should be studied. Ideally the output electrolytic capacitors should be located at the bottom, where the temperature will be the coolest.



If in doubt, consult the manufacturer's installation manual. For high density products, recommended maximum component temperatures will be advised for critical parts.



Conduction Cooled



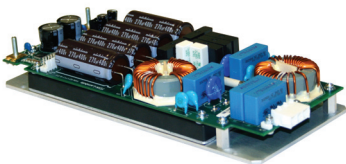
Conduction

Applications

- ◆ Industrial
- ◆ COTS
- ◆ Test & Measurement
- ◆ Communication
- ◆ LED
- ◆ Broadcast

Features

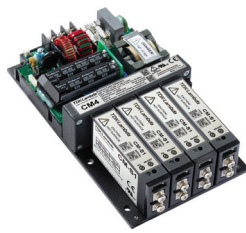
- ◆ High Efficiency
- ◆ High Baseplate Operating Temperature
- ◆ I²C Interface (some models)
- ◆ Protective PCB Coating (some models)
- ◆ Parallel Operation



Value Added Services



- ◆ PFE "Brick on Board" example



CM4 Series



425 to 600W Modular Power Supply

- ◆ Medical & ITE convection/conduction cooled
- ◆ 1U high
- ◆ Wide output adjustment
- ◆ Up to 4 outputs
- ◆ No minimum loading required
- ◆ 5 year warranty



CPFE1000FI Series (Industrial use)



720-1000W Single Output Conduction Cooled

- ◆ Universal Input
- ◆ Smaller size than CPFE1000F
- ◆ Baseplate cooled, no fan required
- ◆ I2C Interface
- ◆ High Efficiency
- ◆ PCB assembly option
- ◆ Protective PCB coating option
- ◆ Parallel up to 6 units
- ◆ Radiated & Conducted Emissions: Class B conducted, Class A Radiated, EN55022/EN55011



CPFE Series (MIL-COTS)



1000W Single Output Conduction Cooled

- ◆ Universal Input
- ◆ MIL STD 461/462D CE102 EMC
- ◆ Baseplate cooled, no fan required
- ◆ I2C Interface
- ◆ High Efficiency
- ◆ Parallel up to 6 units
- ◆ Radiated & Conducted Emissions: Class B and MIL STD 461/462D CE102



CUS400M Series

400W Medical 3" x 5" AC-DC Power Supplies

- ◆ 400W with Forced Air, 250W (400W peak) Convection / Conduction Cooled
- ◆ Medical Certifications (2 x MOPP)
- ◆ Suitable for B and BF Type Medical Equipment
- ◆ Class B Conducted and Radiated EMI
- ◆ Suitable for Class I and Class II Installations
- ◆ Compact 3 x 5 x 1.55" Size
- ◆ Enclosure & Signal Options



PFE-SA & -FA Series (Building Block)



300-1000W Full Brick AC-DC

- ◆ Low profile, small size
- ◆ 100°C baseplate temperature
- ◆ High power density, High Efficiency
- ◆ Parallel capabilities on 500-1000W
- ◆ Peripheral components required to make operational (reference design available)
- ◆ We offer value added services "brick on board," See next pages.



PFH Series (Building Block)



500W AC-DC Power Module

- ◆ Compact 4" x 2.4" x 0.53" brick package
- ◆ 100°C Baseplate temperature
- ◆ PMBus™
- ◆ Peripheral components required to make operational (reference design available)
- ◆ 3 year warranty

Advantages of Conduction Cooled Power Supplies



Most mid to high-power supplies use fans to help dissipate the internal heat that is generated as a result of imperfect AC to DC conversion efficiencies. Since fans are electromechanical devices, they reduce the system's MTBF and add to the required maintenance expenses.

The photo above is a power supply that operated for many years at a postal depot where mail is handled and sorted automatically. As can be seen (after the fan was removed) paper fragments and airborne dust contaminants were pulled into the supply by the fan and eventually caused a blown fuse.

As might be expected, the proper maintenance program for any fan-cooled power supply calls for the periodic inspections of the supply, with the fan removed, and the replacement of the fan with a new one.

A new breed of conduction-cooled power supplies has been developed that do not depend on fans for cooling. Instead, the required cooling is accomplished by conducting the internal heat loads to an external metal structure or enclosure, which act as a large heat sink surface.

Advantages of Conduction Cooled Power Supplies



The photo above shows TDK-Lambda's new CPFE1000FI series, which are conduction-cooled, 1,000 watt AC-DC power supplies. All heat is conducted to the supply's aluminum plate, which is designed to easily mount to a metal enclosure or cold plate for cooling. More details and specifications for these power supplies are at this web link: https://product.tdk.com/info/en/products/power/tec_data/ps_cpfe.html.

In some applications, these conduction-cooled devices are mounted to liquid cooled cold plates that are made of metal with internal serpentine channels through which a liquid circulates while removing the unwanted heat. The net result is that the system operates with a substantial reduction in audible noise, reduced maintenance costs (no dust build-up and fan wear-out), and an enhanced MTBF.

A good example is a visit to a Television Broadcasting Station that consumes about 100 kilowatts of power. At this location, in separate areas, is a traditional fan-cooled system as well as the latest generation system, which uses conduction-cooled power supplies and RF amplifiers that are cooled via liquid flow cold plates. During the operation of the traditional system with fan cooling, the audible noise is so loud that personnel within 100 feet of the system have to wear hearing protection devices. By comparison, in the other area where the new system with liquid cooling is operating, the noise level is so low (similar to an office environment) that no hearing protection is required.